

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2320
Gaithersburg, Maryland 20899-2320

SRM Number: 3168a
MSDS Number: 3168a
SRM Name: Zinc Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of zinc. One unit of SRM 3168a consists of 50 mL of a single element solution in a high-density polyethylene bottle sealed in an aluminized bag. The solution is prepared gravimetrically to contain a known mass fraction of zinc. The solution contains nitric acid at a volume fraction of approximately 10 %.

Material Name: Zinc Standard Solution

Other Designations:

Zinc: Elemental zinc; zinc metal; zinc powder or dust.

Zinc Nitrate: Nitric acid, zinc salt; zinc dinitrate.

Nitric Acid: Aqua fortis; hydronitrate; hydrogen nitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Zinc Nitrate	7779-88-6	231-943-8	2.9
Zinc	7440-66-6	231-175-3	1

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. Zinc and zinc nitrate can irritate the skin, eyes, respiratory tract, and GI tract. "Metal fume fever" may also occur (flu-like symptoms after inhaling zinc or other metal dust).

Physical Hazards: None documented for this mixture. Container may rupture.

Potential Health Effects

Inhalation:	Nitric acid, if inhaled, can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Inhalation of zinc dust or zinc nitrate may irritate the nose, throat, and lungs; chronic exposure may cause GI upset. Symptoms of "metal fume fever" from inhalation of zinc include muscle aches, nausea, weakness, fatigue, headache, chills, and fever.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Contact with zinc metal or dust may cause skin irritation and mild dermatitis. Zinc nitrate is corrosive and can cause more severe irritation or burns.
Eye Contact:	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Zinc and zinc nitrate can cause eye irritation and may burn the cornea; symptoms may include blurred vision, pain, and conjunctivitis.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. Ingestion of zinc or zinc nitrate can cause abdominal pain, nausea, vomiting, and diarrhea; long-term ingestion of zinc may damage the GI tract, kidneys, and other organs. A large oral dose of zinc may cause dizziness, staggering gait, anemia, lethargy, or other symptoms. Repeated or prolonged ingestion of inorganic nitrates can cause anemia, kidney disease, and blood abnormalities.

Medical Conditions Aggravated by Exposure: The mixture may aggravate pre-existing disorders of the eyes, skin, GI tract, respiratory tract, and prostate. Persons who take zinc dietary supplements may be more susceptible than others to the effects of exposure to zinc.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. If not breathing, qualified personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO₂). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

Note to Physician (Zinc): Chelation therapy has been used successfully to treat acute zinc poisoning.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Although nitric acid and zinc nitrate do not burn, both are powerful oxidizing agents that can react with combustible materials to cause fires. Finely divided zinc powder (not present in this mixture) is flammable and may ignite or explode.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire, but do not use halogenated extinguishing agents, carbon dioxide, or dry chemicals. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 2 ppm or 5 mg/m³
OSHA TLV-TWA: 2 ppm or 5 mg/m³

Zinc Nitrate:

ACGIH TLV-TWA: None established. Total dust, 10 mg/m³; respirable dust, 3 mg/m³
OSHA TLV-TWA: None established. Total dust, 15 mg/m³; respirable dust, 5 mg/m³

Zinc:

ACGIH TLV-TWA: 5 mg/m³ (as ZnO, respirable dust or fume)
OSHA TLV-TWA: 2 mg/m³ (as ZnO, respirable fraction)

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Zinc Nitrate	Zinc
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Colorless to white hygroscopic crystals; odorless	Appearance and Odor: White powder; odorless
Relative Molecular Weight: 63.02	Relative Molecular Weight: 189.39	Relative Molecular Weight: 65.38
Molecular Formula: HNO ₃	Molecular Formula: Zn(NO ₃) ₂	Molecular Formula: Zn
Specific Gravity: 1.0543 (10%)	Specific Gravity: Not found for anhydrous form	Specific Gravity: 7.14
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Soluble in alcohol	Solvent Solubility: Soluble in alcohol, alkali metals, and acetic acid
Water Solubility: Soluble	Water Solubility: Soluble	Water Solubility: Insoluble; reacts with water
Boiling Point (°C): 86 (187°F)	Boiling Point (°C): Not found for anhydrous form	Boiling Point (°C): 907 (1665°F)
Melting Point (°C): -42 (-43.6°F)	Melting Point (°C): Not found for anhydrous form	Melting Point (°C): 419 (786°F)
Vapor Pressure (Pa): 946 @20°C	Vapor Pressure (Pa): Not found for anhydrous form	Vapor Pressure (Pa): 133 @ 487°C (909°F)
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): Not found for anhydrous form	Vapor Density (Air=1): N/A
pH: 1.0 (0.1M solution)	pH: 5.1 (5% aqueous solution)	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of zinc and nitric acid. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Heat; contact with combustible materials and other incompatible materials.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Zinc Nitrate: Incompatible with acids, combustible materials, cyanides, metals, metal salts, sodium hypophosphite, stannous chloride, phosphorus, thiocyanates, carbon, metallic sulfides, and reducing agents.

Zinc: Incompatible with acids, bases, metals, oxidizing materials, reducing agents, halocarbons, halogens, combustible materials, metal oxides, and amines.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of nitric acid or zinc nitrate can produce nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), and nitrous oxide (N₂O). Nitric acid mist or vapor may also be produced. Thermal decomposition of zinc may release zinc oxide or other toxic or hazardous fumes.

Hazardous Polymerization: Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg

Rat, oral: LD₅₀ > 90 mg/kg

Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Zinc Nitrate:

Rat, oral: LD₅₀ = 2500 mg/kg

Rabbit, skin: 500 mg (24 hrs) caused severe irritation

Zinc:

Human, inhalation: TC_{Lo} (50 min) = 124 mg/m³

Human, skin: 300 µg (3 days) caused skin irritation

Target Organ(s): Respiratory tract, eyes, skin, GI tract, kidneys, blood.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. Human cell cultures pretreated with soluble zinc salts showed increased numbers of cells with chromosomal breaks and other abnormalities.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L
Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L
Hooknose (*Agonus cataphractus*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L
Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L
Cockle (*Cerastoderma edule*): LC₅₀ (48 hrs) = 330,000 to 1,000,000 µg/L

Zinc Nitrate: No acute ecotoxicity data are available for this zinc compound.

Zinc:

Fleshy prawn (*Penaeus chinensis*): LC₅₀ (48 hrs) = 645 µg/L
Spire snail (*Amnicola* sp.): LC₅₀ (48 hrs) = 330,000 to 1,000,000 µg/L
Bluegill (*Lepomis macrochirus*): LC₅₀ (96 hrs) = 14,000 µg/L

Environmental Summary: This mixture is expected to be toxic to aquatic organisms. Do not release to the environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture are classified as RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Nitric Acid Solution; Hazard Class 8, UN2031, Packing Group II

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lbs.
Zinc Nitrate: RQ = 1000 lbs.
Zinc: RQ = 1000 lbs.

SARA Title III Section 302: Nitric acid is regulated.

SARA Title III Section 304: Nitric acid is regulated.

SARA Title III Section 313: Nitric acid, zinc nitrate, and zinc fume or dust are regulated.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations (≥ 94.5%) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes
CHRONIC:	Yes
FIRE:	No
REACTIVE:	Yes
SUDDEN RELEASE:	No

STATE REGULATIONS

California Proposition 65: None of the components are regulated.

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)
Zinc Nitrate: C (oxidizing material), D2B (toxic material)
Zinc: D2B (toxic material).

WHMIS Ingredient Disclosure List: Nitric acid is regulated.

CEPA Domestic Substances List (DSL): All three components are regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)
Zinc Nitrate: O (Oxidizer); not classified in Annex I of Directive 67/548/EEC; not on a priority list.
Zinc: N (Dangerous for the Environment)

Risk Phrases (mixture):

R23 (toxic by inhalation)
R25 (toxic if swallowed)
R34 (causes burns)
R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)
S28 (wash after contact with skin)
S45 (in case of accident or illness, see doctor; show label)
S60 (dispose of this material and its container as hazardous waste)
S61 (avoid release to the environment)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: No components are listed.

16. OTHER INFORMATION

Sources:

Hazardous Substances Data Bank (HSDB): Zinc and Zinc Nitrate.

IUCLID Chemical Data Sheet: Nitric Acid. European Chemicals Bureau, 19 February 2000.

IUCLID Chemical Data Sheet: Zinc. European Chemicals Bureau, 19 February 2000.

PAN Pesticide Database: Zinc.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, June 1990 edition. DHHS (NIOSH) Publication No. 90-117.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.